



Fire Protection Training

Procedures Handbook 4300

VEHICLE EXTRICATION

TOPIC: PULLING, SPREADING, PRYING OPERATIONS WITH LIGHT RESCUE TOOLS

TIME FRAME: 2:00

LEVEL OF INSTRUCTION: Level II

BEHAVIORAL OBJECTIVE:

Condition: A written examination

Behavior: The student will describe factors affecting light rescue tool use

Standard: With a minimum of 70% accuracy, according to the information contained in this lesson plan

MATERIALS NEEDED:

- Tools to be displayed including:
- Hydraulic powered hand operated ram
- Wedge
- Spreader
- Jack
- Pry axe

REFERENCES:

- Principles Of Vehicle Extrication, IFSTA, 1ST Edition
- Fire Service Rescue, IFSTA, 6th Edition

PREPARATION: Many accident victims can be extricated quickly and safely using simple hand tools. If your powered rescue tool fails to start or a seal fails, you may have to rely on hand tools. You can accomplish the same objective, freeing a trapped victim, with different equipment. The utilization of simple tools in extrication can be both rapid and effective.



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PRESENTATION	APPLICATION
<p>I. PULLING OPERATIONS WITH LIGHT RESCUE TOOLS</p> <p>A. Introduction</p> <ol style="list-style-type: none">1. The ability to gain access to or disentangle victims is often greatly aided by the use of leverage or other forms of mechanical advantage. The subject of mechanical advantage can become a very technical and lengthy one. We will try to avoid this, and instead, try to pass on some principles that will help you function more effectively at the incident scene <p>B. For every action there is an equal and opposite reaction</p> <p>NOTE: Reinforce point that the results of all actions should be considered first</p> <ol style="list-style-type: none">1. When we set out to meet an objective that requires the use of some sort of mechanical advantage, all we see is the desired result2. Remember: Whenever you push, pull, spread or whatever, take a second, and take a look. What is going to happen if you push here or pull there? Something else may be moving where you do not want it. Try to look at the total effect your actions might have before you take them <p>NOTE: Discussion: How this applies to all phases Stabilization Access Disentanglement; etc.</p> <p>II. EQUIPMENT TO BE USED</p> <p>A. Cable come-along</p> <p>B. Jacks</p>	

PRESENTATION	APPLICATION
<ol style="list-style-type: none"> 1. Farm (high lift) 2. Hydraulic 3. Vehicle <p>C. Porto powers</p> <p>D. Improvised systems</p> <p>E. Chain</p> <p>III. CHAIN</p> <p>A. A frequently used tool in mechanical advantage systems, but seldom understood</p> <p>B. Grades</p> <ol style="list-style-type: none"> 1. Expressed as numbers (70 or 80) 2. The grade of the chain should be stamped every one foot <ol style="list-style-type: none"> a) Grade of chain used in rescue operations should be grade 80 3. When working with mechanical advantage systems, the working strength is very important; you do not want to exceed it 4. The assumption that a chain is a chain, and the bigger the chain the better, is not true 5. General guidelines - find out about your chain ahead of time <ol style="list-style-type: none"> a) What is it designed for? 	<p>What types of jacks are available?</p> <p>If a chain is bigger, is it also stronger and better?</p>



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<ul style="list-style-type: none">b) What is its working strength?c) What condition is it in?d) Size of chain is determined by diameter of rod forming <p>C. Application</p> <ul style="list-style-type: none">1. Rescue chain<ul style="list-style-type: none">a) Life safetyb) Must be rated, load testedc) Must be labeled with load rating, date, inspector information2. Utility chain<ul style="list-style-type: none">a) General useb) Moving and pulling objectsc) Should be labeled with a tag stating date placed in service and maximum working load <p>D. Safety</p> <ul style="list-style-type: none">1. Know what you want to use the chain for and the load requirements before selecting the chain2. Some safety considerations to look for when checking the condition of a chain<ul style="list-style-type: none">a) Check the links for<ul style="list-style-type: none">1) Distortion (out of shape)	<p>What are some of the safety considerations when using chain?</p>

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<div data-bbox="375 323 1040 1178"> <ol style="list-style-type: none"> 2) Worn spots (ground down or cut) 3) Cracks b) The overall length of the chain can be checked by examining the overall condition of the chain, for damage due to overloading 1) Need to have a starting measurement (preferably when the chain is new) 2) Evaluating the chain by measurement may seem unimportant, but this is the only way to detect compound damage due to excessive loading 3) Will even indicate otherwise undetectable damage to a number of links (is a measure of compound damage) </div> <div data-bbox="147 1192 631 1228"> <p>NOTE: Demonstrate procedure</p> </div> <div data-bbox="451 1243 1029 1745"> <ol style="list-style-type: none"> 4) How to measure <ul style="list-style-type: none"> • Lay chain out on flat surface • Stretch chain out straight • Pull tight • Measure total length of the chain only (make the measurement as accurate as possible) from end link to end link; do not measure the hooks, etc. </div>	<div data-bbox="1136 766 1446 802"> <p>Why measure chain?</p> </div>



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<ul style="list-style-type: none">• A difference of as little as 1/8" indicates that overloading has occurred <p>5) Measurement should be recorded as original measurement</p> <ul style="list-style-type: none">• On metal tag on chain if possible or in a log• Record any subsequent measurement and date taken in a log also <p>6) When to measure</p> <ul style="list-style-type: none">• Any time it is felt the chain may have been overloaded• At a regular inspection interval <p>7) When to remove from service</p> <ul style="list-style-type: none">• Any deviation in length should be carefully evaluated as to possible damage to chain, its serviceability and safety• If there is any doubt, it should be replaced <p>NOTE: Use equipment to demonstrate</p> <p>E. Hardware</p> <p>1. Types</p> <p>a) Grab hook</p> <p>1) Designed to grab the chain</p> <p>NOTE: Show each piece of hardware as it is described and demonstrate as needed</p>	

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<ul style="list-style-type: none">2) Has a narrow throat to fit chain and not slipb) Slip hook<ul style="list-style-type: none">1) Designed to slide along chain to allow loop of chain to tighten around object2) Has a wide, rounded throatc) Master link<ul style="list-style-type: none">1) A ring that can be in various shapes (pear, round, oval) and various sizes2) Used as a pulling point in chain setsd) Hammer link<ul style="list-style-type: none">1) Links chain to other permanent hardware2) Should match rating of chain2. Designed<ul style="list-style-type: none">a) For heaviest grade of chainb) For specific chain size<ul style="list-style-type: none">1) 5/16th" hardware is for 5/16th" chain, not 1/4" or 3/8"3. Safety<ul style="list-style-type: none">a) Inspect as you would a link of chainb) Use hardware the way it was designed	

NOTE: Information Sheet #1

- 1) Especially hooks

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<ul style="list-style-type: none">• Do not place hooks so that load is placed on tip (load should be in bottom of throat)• Also the load should not pull at too great an angle from the long axis of the hook• This would load the hook along the shaft rather than in the bottom of the throat• Hook should not be used in an application where in the chain is between the hook and another surface, as this can cause the surface to push the hook off of the chain• The hook should be between any surface and the chain, with the opening of the hook away from the surface <p>NOTE: Show tow chain</p> <p>F. Chains and chain sets</p> <ol style="list-style-type: none">1. Tow chain sets<ol style="list-style-type: none">a) Found on most emergency apparatusb) Usually<ol style="list-style-type: none">1) 7/16th" diameter2) 15' to 25' long3) Has some combination of grab and/or slip hooks on its ends	

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<div data-bbox="456 327 1040 1008"><ol style="list-style-type: none">1) By wrapping chains around objects or hooking directly to objects with hooks2) Can be made adjustable<ul style="list-style-type: none">• To make adjusting device, join two grab hooks with 3 links of chain, hook ends of tow chain to lead and anchor, then hook one grab hook of adjusting device onto chain• Pull slack out of chain and hook second grab hook• This will avoid doubling or multiple wraps of the chain to remove unwanted slack</div> <div data-bbox="151 1022 876 1056"><p>NOTE: Show chain set and use to illustrate parts</p></div> <div data-bbox="303 1073 532 1106"><p>2. Chain sets</p></div> <div data-bbox="378 1142 660 1176"><p>a) Found in pairs</p></div> <div data-bbox="456 1211 964 1457"><ol style="list-style-type: none">1) One long chain<ul style="list-style-type: none">• Usually 10' - 12' in length2) One short chain<ul style="list-style-type: none">• Usually 5' in length</div> <div data-bbox="378 1488 596 1522"><p>b) Hardware</p></div> <div data-bbox="456 1558 1018 1770"><ol style="list-style-type: none">1) Same on both<ul style="list-style-type: none">• Slip hook on one end• Master link on other end with grab hook attached to it</div> <div data-bbox="378 1803 907 1837"><p>c) Identification of different lengths</p></div>	

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<p>1) Hooks and master link on long and short chains painted different colors</p> <p>2) Master links on long and short chains are generally a different shape (such as round or oval)</p> <ul style="list-style-type: none">• Round on short chain• Oval on long chain <p>d) Use</p> <p>NOTE: Demonstrate use. Use one student and talk them through the procedure to better get it across. Leave the chain sets out at break for the students to familiarize themselves with it. Most people seem to take them for granted and are unable to use them properly at drills or in the field</p> <p>1) With slip hook end of chain</p> <ul style="list-style-type: none">• Take two wraps around object• Hook slip hook on chain <p>2) With grab hook/master link end of chain</p> <ul style="list-style-type: none">• Adjust master link to obtain correct length• Hook grab hook on chain <p>IV. CABLE COME-A-LONG</p> <p>NOTE: Have come-along available to show parts</p> <p>A. Also known as a hand winch</p> <p>1. An excellent tool for gaining mechanical advantage in a variety of pulling operations</p> <p>B. Comes with variety of features</p>	



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<ul style="list-style-type: none">1. Light and heavy duty, stamped steel or cast housings2. Pulling capacities usually from 2,000 to 6,000 pounds, depending on model3. Cable lengths may vary from 10' to 50', depending on model4. Chain up to 20' <p>NOTE: Point out parts on come-a-long as they are described</p> <p>C. Basic construction</p> <ul style="list-style-type: none">1. Main frame<ul style="list-style-type: none">a) Holds mechanism togetherb) May be of cast aluminum or stamped steel constructionc) Cheaper cable come-a-longs usually have frames that are not as strong as the cable2. Drum<ul style="list-style-type: none">a) Holds cableb) Has teeth on one side for spooling cable in and outc) Most come-a-longs hold an average of 20' to 25' of cable3. U-frame moved back and forth to spool cable in and out4. Cable shield<ul style="list-style-type: none">a) Helps cable spool evenlyb) Keeps cable tight on drum	

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<ul style="list-style-type: none">5. Main frame pawl<ul style="list-style-type: none">a) Keeps cable from spooling outb) Used to free spool cable out under load6. Reverse lever (located on U-frame)<ul style="list-style-type: none">a) Used to control direction of cable movement when the U-frame is actuated7. Safety handle<ul style="list-style-type: none">a) Used to give leverage in actuating the U-frame (spooling cable in and out)b) Designed to fail (bend) before the come-a-long's capacity is exceeded<ul style="list-style-type: none">1) Do not substitute pipe or other materials2) Will not provide safety factor3) Could exceed the capacity of the come-a-long8. Cable<ul style="list-style-type: none">a) Carries the loadb) Safety<ul style="list-style-type: none">1) Do not handle cable with bare hands; wear gloves<ul style="list-style-type: none">• Injury from broken strands2) When handling cable, do not let it slide through your hands to get	<p>Why should you not substitute pipe for safety handle?</p>

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<p>caught on the broken strands; use a hand-over-hand method</p> <p>3) Check for defects</p> <ul style="list-style-type: none">• Flat spots - weaken cable. Cable is at its strongest if it is round and the strands can interact with each other when a load is applied• Worn spots• Broken strands• If defects are found, replace cable immediately <p>9. Cable guide keeps cable in alignment with the drum</p> <p>10. Main frame hook</p> <p>a) Hook at end of main frame used to attach to an object/anchor - usually a slip hook</p> <p>11. Hook (cable end)</p> <p>a) Used to attach the cable end to</p> <p>1) A load</p> <p>2) An anchor</p> <p>3) The main frame</p> <p>b) Usually a slip hook</p> <p>12. Snatch block</p> <p>a) Pulley with slip hook attached</p> <p>b) Used to</p>	

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<div data-bbox="456 327 984 432"><ul style="list-style-type: none">1) Increase mechanical advantage2) Change direction of cable</div> <div data-bbox="228 464 636 499">D. Pulling operation set up</div> <div data-bbox="305 531 555 567">1. Terminology</div> <div data-bbox="380 674 1032 921"><ul style="list-style-type: none">a) Load - the object to be movedb) Anchor - the object to attach the come-along to that will not move when the load is pulled</div> <div data-bbox="305 955 526 991">2. Procedure</div> <div data-bbox="380 1024 1040 1785"><ul style="list-style-type: none">a) Get all the equipment you need first<ul style="list-style-type: none">1) Come-a-long2) Handle3) Chains4) Cribbing (if needed)b) Wrap chain around anchor and securec) Wrap chain around load and secure; adjust to lengthd) Hook main frame hook to load, single line versus double line pull<ul style="list-style-type: none">1) Single line pull<ul style="list-style-type: none">• Hook at end of cable attached to load</div>	<div data-bbox="1144 585 1464 653">What does "load" refer to?</div> <div data-bbox="1144 726 1425 793">What does "anchor" refer to?</div>

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<ul style="list-style-type: none">• Will pull full rated capacity in double line pull, and only half of rated capacity in a single line pull• Come-a-long is rated on a double line pull• Will have twice the reach of double line• Moves the load at 1:1 ratio; for every 1' of cable spooled in the load, the load will move 1 foot <p>2) Double line pull</p> <ul style="list-style-type: none">• Hook at end of cable is attached to end of main frame or other anchor and load is attached to hook on snatch block come-a-long• Will function at total rated capacity, usually 4,000 pounds (2 tons)• Has only half the reach of single line• Moves the load at a 2:1 ratio; for every 2' of cable spooled in the load, the load will move 1 foot• Also pulls at a 2:1 mechanical advantage: pounds of force needed vs. pounds of load <p>e) Free spool cable out</p>	<p>What do we mean by a 2:1 ratio?</p>

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<ol style="list-style-type: none"> 1) Reverse lever in lowering/backing off position 2) Hold main frame by sides 3) Release main frame pawl with thumb 4) Pull come-a-long towards anchor paying out cable <ul style="list-style-type: none"> • Avoid pulling cable off drum without a load • Doing this will loosen the cable on the drum • Cable could cross and cause wedging on drum or damage when a load is applied to the cable 5) Put out enough cable <ul style="list-style-type: none"> • You can only bring in as much cable as you put out • Keep the chains to the load and anchor adjusted short. This gives you the maximum cable length and potential for load movement f) Hook main frame hook to anchor g) Adjust chain to length and hook h) Protect cable, snatch block and main frame <ol style="list-style-type: none"> 1) Things to avoid 	

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<ul style="list-style-type: none">• Sharp bends in cable can flatten or otherwise damage the cable; cable has its greatest strength when it is round• Lengthen chains to load or anchor to avoid damage to the cable or place cribbing to remove bend <p>2) Keep the hooks facing up so they will not catch on anything</p> <p>3) Do not place the main frame in a bind</p> <ul style="list-style-type: none">• Load should be transmitted straight through the long axis of the main frame; placing it in a bind could damage it• Place cribbing under or lengthen the anchor chain to correct <p>4) In general</p> <ul style="list-style-type: none">• The pull should be as straight as possible from the main frame hook to the load end of the cable <p>i) Install handle</p> <p>j) Place reverse lever in pulling/lifting position</p> <p>k) Start pulling operation</p>	<p>Why should hooks face up?</p>

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<p>E. Lowering/backing off requires load of about 15 pounds or more than the load on the drum</p> <ol style="list-style-type: none">1. Move reverse lever to lowering/backing off position2. Move handle towards load until it disengages main frame pawl (you should hear a click)3. Move handle towards main frame hook<ol style="list-style-type: none">a) You should hear another click as the U-frame pawl disengagesb) Repeat process4. Considerations for slacking cable<ol style="list-style-type: none">a) Move handle smoothly; do not slam it back and forthb) Most come-a-longs will only lower/backoff one tooth at a timec) Do not try to release main frame pawl while come-a-long is under load; this could result in uncontrolled release of cable <p>F. General considerations (care and safety)</p> <ol style="list-style-type: none">1. Keep the come-a-long clean<ol style="list-style-type: none">a) Any corrosion to the cable and it should be replaced	<p>Why should you not try to release mainframe pawl while come-a-long is under load?</p> <p>What are some of the safety considerations when using the come-a-long?</p>

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<ul style="list-style-type: none">2. Lubricate as recommended by manufacturer3. Keep the cable on the drum neat and tight<ul style="list-style-type: none">a) This will avoid potential wedging or damage to cableb) Apply about 10 pound load at cable end while rewinding cable4. Check main frame and other parts for damage5. If the handle is removable, carry a spare	<p>Why should the cable be kept tight on the drum?</p>
V. JACKS <ul style="list-style-type: none">A. Farm jack<ul style="list-style-type: none">1. Also known as highlift or handiman jacks2. Can be used as a<ul style="list-style-type: none">a) Clamp - develops approximately 750 pounds forceb) Winch (come-along) - develops approximately 7,000 pounds forcec) Jack - develops approximately 7,000 pounds force in the first two-thirds of the jack stand3. Available in a number of models, usually from 42" to 62" in height4. A very valuable and cost effective tool<ul style="list-style-type: none">a) Must be used with careb) If used improperly, can be dangerous	

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<p>NOTE: Display and demonstrate</p> <p>5. Basic construction</p> <ul style="list-style-type: none">a) Base plate<ul style="list-style-type: none">1) Provides stabilityb) Head (lifting mechanism)<ul style="list-style-type: none">1) Device that moves along standard to provide pulling, pushing or lifting effectc) Standard (beam)<ul style="list-style-type: none">1) Shaft of either casting or all steel along which the head movesd) Top handle<ul style="list-style-type: none">1) Bolted to top of standard2) Placed perpendicular to standard for clamping operationse) Handle for actuating lifting mechanism (head)f) Shear pin bolt<ul style="list-style-type: none">1) Protects the jack from overloading2) The load will not fall when it shears3) Replacement is necessary to move the load, usually a 5/16" x 2-1/3" SAE grade 2 boltg) Nose<ul style="list-style-type: none">1) Part of head used for liftingh) Climbing pins	

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<ol style="list-style-type: none"> 1) If you have a problem, it will most likely be here - dirt, sand, etc., or lack of lubrication will cause the climbing pins to stick and fail to engage the standard i) Reversing latch <ol style="list-style-type: none"> 1) Found on side of head 2) Controls direction the head travels when working under load j) Extension tube <ol style="list-style-type: none"> 1) Piece of rectangular steel tube with saddle welded on top for supporting loads 2) Standard slips inside of tube and tube rests on top of head, as head moves up standard tube moves up. The extension tube is not as strong as the beam 3) Excellent stabilization tool 4) An increase in length = decrease in capacity <ul style="list-style-type: none"> • Only lift height or length of the jack bar 6. Use - actuating lift mechanism during applications <ol style="list-style-type: none"> a) To move up standard 	<p>Why does the lifting capacity of the farm jack decrease when the extension tube is used?</p>

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<div data-bbox="456 327 1029 646"><ol style="list-style-type: none">1) Move reverse lever to up position2) Move handle down until you hear a click; this is the climbing pin engaging3) Move the handle up until you hear another click; this is the second climbing pin engaging</div> <div data-bbox="380 678 1036 1066"><p>b) To move down standard</p><ol style="list-style-type: none">1) With the reverse lever in the down position2) Operate the same as raising3) Caution: If the jack is not loaded to at least 100 pounds when lowering step by step, the head will automatically drop to the base level</div> <div data-bbox="380 1245 1052 1749"><p>c) Safety</p><ol style="list-style-type: none">1) While moving the handle down (in both raising and lowering), you are supporting the load<ul style="list-style-type: none">• Releasing the handle will result in the handle moving rapidly upward (depending on the load)</div>	<p data-bbox="1143 1087 1446 1224">What are some of the safety considerations when lowering the load?</p> <p data-bbox="1143 1444 1414 1581">If your grip on the handle slips, which direction will the handle move?</p>

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<ul style="list-style-type: none">• Avoid leaning over or straddling the handle; it could ruin your day• If someone is assisting the operation by holding the top of the standard, have them hold the top handle instead• The handle may also continue to move up and down rapidly <p>2) Always make sure jack is stable before starting an operation</p> <ul style="list-style-type: none">• Both at base/anchor and load• If base is not flat on ground, crib the base to provide stability <p>NOTE: Discuss safety aspects of using jacks as sole supports</p> <p>3) When lifting operation is finished and the jack is to remain in place, <u>always</u> leave handle in up position with a safety clip in place</p> <p>4) Avoid working under raised loads; use additional supports, cribbing, etc.</p> <p>5) Do not push a load off the jack</p> <p>d) Operation as a winch</p> <ol style="list-style-type: none">1) Bolt top handle in a vertical position2) Chain to anchor, adjust length and connect to top handle3) Chain to load, adjust to length and secure to hold in nose	



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<ul style="list-style-type: none">4) Put reverse lever<ul style="list-style-type: none">• In up position to pull• Down position to back offe) Using the jack for pulling<ul style="list-style-type: none">1) Place jack in vertical position in line between anchor and load<ul style="list-style-type: none">• Position base closer to load than to anchor• This will give more lifting effect2) Run chain(s) from the load to the anchor3) Put chain over nose of jack with head in lowest position4) Adjust chain to length5) Actuate lifting mechanism to pull load<ul style="list-style-type: none">• If jack is not in line between load and anchor, it will want to tip• Assistance may also be helpful by having someone hold the top standard• It also may be necessary to place cribbing or other material under the base to increase its area of contact	
B. Hydraulic, scissor and bumper jacks	

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PRESENTATION	APPLICATION
<ol style="list-style-type: none">1. These tools are readily available and can be used in the same manner as the farm jack (when used as a jack) but their capacity is less2. The pull will not be as far, but after the jack is extended fully, it can be retracted, the chain tightened and the jack raised again3. The hydraulic jacks will require the use of a saddle on top of the piston for the chain to rest in<ol style="list-style-type: none">a) This can be constructed with a short piece of pipe to go over the end of the piston with a curved piece welded on top of it to hold the chain	
VI. HYDRAULIC PORTO-POWER <ol style="list-style-type: none">A. The spreading, prying and pushing of objects is often achieved with the use of hand-operated hydraulic equipment best known under the trade name Porto-PowerB. Comes in a number of sizes - usually 4, 10 and 20 ton NOTE: Show students the equipment <ol style="list-style-type: none">C. Has a tremendous number of accessories (we will only deal with a few basics)D. Basic components<ol style="list-style-type: none">1. Pump<ol style="list-style-type: none">a) Acts as reservoir for hydraulic fluid and houses the pump2. Hose<ol style="list-style-type: none">a) Connects pump and different appliances3. Hydraulic appliances and accessories	



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PRESENTATION	APPLICATION
<p>a) Wedge</p> <ol style="list-style-type: none">1) Small spreader2) Capable of generating approximately 2,000 pounds of force at its tips3) Spreads approximately 3" to 4" at its tips <p>b) Accessories (used with rams)</p> <ol style="list-style-type: none">1) Ram toe<ul style="list-style-type: none">• Used in conjunction with plunger toe or other base in spreading• Protective plastic ring must be removed from ram to install toe2) Extension tubes<ul style="list-style-type: none">• May pin together with lock pins, thread together or slip together• If tubes use lock pins, put them in from the same side• When working in confined spaces, adjustments will be easier and the pins will not be in the way• Carry a tape measure with the tool	<p>What value is a tape measure?</p>

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PRESENTATION	APPLICATION
<ul style="list-style-type: none">• Ram can be built to the exact size without a waste of time• Extension tubes decrease the stability of the load and designed only to be used with shorter rams. Check with manufacturers recommendation <p>3) Support lock (adjustable extension)</p> <ul style="list-style-type: none">• Can be built into ram allowing final adjustment to fit space• Additional length without adding tubes• After ram is fully extended, retract it and extend the adjustable extension and extend the ram again <p>4) Bases</p> <ul style="list-style-type: none">• Numerous to fit different situations• Some will increase surface area• Some will compensate for shape or surface conditions <p>c) Spreader</p> <p>1) Longer arms allow greater spreading capability</p> <p>2) Typically generates over 2,000 pounds force at tips</p>	

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PRESENTATION	APPLICATION
<ul style="list-style-type: none">3) Spreads approximately 10-3/4" at its tipsd) Ram<ul style="list-style-type: none">1) Used for pushing operations in conjunction with various bases and extensions used to fit the desired situation2) The capacity and stroke of ram depends on its size <p>E. Use</p> <ul style="list-style-type: none">1. Spreading<ul style="list-style-type: none">a) Set up<ul style="list-style-type: none">1) If not pre-connected, hose from pump is screwed into the connection on the appliance<ul style="list-style-type: none">• Check the ends of the connections for any contamination• There may be protective caps on connectionsb) Operation<ul style="list-style-type: none">1) Usually used in pairs-wedge and spreader<ul style="list-style-type: none">• For identification and communications painting the wedge and its pump one color and the spreader and its pump another color is a big help2) The tops of either tool can be placed between the objects to be spread	

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PRESENTATION	APPLICATION
<ul style="list-style-type: none">• It may be necessary to make or enlarge an opening with another tool <p>3) To spread the tips, actuate the pump handle</p> <ul style="list-style-type: none">• To obtain pressure, the valve on the pump must be closed• If tips fail to spread, hydraulic fluid level may be down• With pump end down, loosen nut on opposite end and remove the check level• When pumping, hold the pump vertically in front of you• Pump end down <p>4) To bring the tips back together</p> <ul style="list-style-type: none">• Open the valve on the pump to bleed off the pressure <p>2. Pushing</p> <p>a) Set up the ram</p> <ol style="list-style-type: none">1) Evaluate surfaces to be pushed against and select bases2) Measure distance between surfaces<ul style="list-style-type: none">• A tape measure is helpful3) Select extensions to fit the space4) Assemble bases, extensions and ram	

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PRESENTATION	APPLICATION
<p>5) Attach pump and put in place</p> <p>b) Operation</p> <p>1) Make sure valve on the pump is closed</p> <p>2) Hold pump vertically with pump end down</p> <p>3) If ram is fully extended and more distance is required</p> <ul style="list-style-type: none">• Retract ram and add extension• Consider use of adjustable extensions <p>F. General considerations</p> <p>1. Power</p> <p>a) Putting a 20-ton pump on a 4-ton appliance does not give you a 20-ton appliance</p> <p>1) Major differences in pumps are</p> <ul style="list-style-type: none">• Reservoir capacity• Stroke volume of pump• Most pumps, whether 10 or 20 ton, put out between 7,000 and 10,000 PSI <p>2) Major differences in appliances are</p> <ul style="list-style-type: none">• Size• Weight• Surface area of piston	

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PRESENTATION	APPLICATION
<p data-bbox="305 327 464 359">2. Rams</p> <p data-bbox="380 396 1013 743">a) Stability of the ram decreases</p> <p data-bbox="457 466 857 497">1) With increase in length</p> <p data-bbox="457 535 1013 638">2) When working with offset accessories that load it off its long axis</p> <p data-bbox="380 676 990 743">b) Extensions typically only fit on shorter rams</p>	



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PULLING, SPREADING,
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SUMMARY:

Review pulling, spreading, prying operations with light rescue tools.

EVALUATION:

A written examination.

ASSIGNMENT:

To be determined by instructor(s).